

Determinant of Low Birth Weight and Preterm Birth at Public Health Facilities in Assosa Zone, Ethiopia: Cross-sectional Study

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Abstract

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Background: Preterm birth and low birth weight account the largest proportion of adverse birth outcomes and are common cases of neonatal mortality. Whereas reasons for the occurrence of such adverse outcomes are less studied.

Objectives: This study was done to identify factors associated with preterm birth and low birth weight among mothers who gave birth in health facilities at Benishangul Gumuz Region, Ethiopia, 2020.

Methods: A cross sectional study was employed among 477 randomly selected mothers who gave birth in health facilities at Benishangul Gumuz, Ethiopia in 2020. The data was collected electronically using CS-Entry android device and analyzed using SPSS version 25.0. Simple and multiple binary logistic regression analyses were used to identify factors independently associated with preterm birth and low birth weight at p-value less than 0.05.

Results: Pregnancy-related complications, history of still birth, birth before 37 weeks and mothers with no additional daily meal during pregnancy were significantly associated with 2.4, 3.3, 5.0 and 2.3 higher odds of low birth weight, respectively. Mothers who reside at rural areas, and who cannot read or write were having 2.7 and 5.4 times higher odds of preterm delivery, respectively. Inter-pregnancy interval of <24 months was associated with 1.9 higher odds of preterm birth and 1.7 higher odds of low birth weight.

Conclusion: In this study it was identified that complications during pregnancy, history of still birth, and no additional daily meal during pregnancy were found to be significant predictors of low birth weight. Low maternal educational status and rural residence were associated with low birth weight. Where, shorter interpregnancy interval is found to be strongly associated low birth weight and preterm birth. Tackling pregnancy-related complications and strengthening postnatal family planning service is vital in addressing issues related to inter-pregnancy intervals as well as reducing low birth weight and preterm deliveries.

Keywords: Preterm, Low birth weight, Factors, Mothers

Background

Normal term pregnancies last between 37 and 40 completed weeks of gestation, and normal birth weight baby is a birth weight of 2.5- 4 kilograms (Kgs) (1). An adverse birth outcome (ABO) is a birth with conditions such as stillbirth, low birth weight, preterm birth and others. From these, preterm birth (PTB) and low birth weight (LBW) constitute the largest portion(2) World Health Organization (WHO) defines preterm birth as all births before 37 completed weeks of gestation, from the first date of a woman's last menstrual period Where, low birth weight is defined as a birth weight of fewer than 2500 grams at birth (3).

Low birth weight and preterm birth constituted the highest rates of all the adverse birth outcomes and are common in developing countries especially, in Sub-Saharan African countries including Ethiopia (4). Globally, 15 million babies born too early each year from which more than one million die due to complications related to preterm birth (5). According to United States Agency for International Development (USAID's) report among 24 priority countries including Ethiopia, the preterm birth rate is 11.3% (6); in some areas of the country it is reported to be as high as of 35% (7). In Ethiopia, 377,000 babies are born preterm each year and 23,100 children die due to direct preterm complications (8). According to United Nation International Children's Emergency Fund (UNICEF) report of 2015, the global LBW prevalence was 14.6% , with higher prevalence in South Asia and Sub-Saharan Africa (9). In Ethiopia according to Ethiopia Demographic and Health Survey (EDHS) 2016 report on birth weight, 13 % of total births were with low birth weight (10). With variable magnitude in different areas of the country low birth weight ranges from 7.8% in Jimma (11) to 40% in Gondar (7).

Preterm birth and low birth weight infants are at greater risk for mortality and prone to different health problems as well as developmental problems. Because many of the of low birth weight are due to early birth before fully maturation, complications arising in both cases are mostly overlapping (12). Evidences show that preterm delivery and low birth weight increase the risk of perinatal mortality (13). Preterm birth was one of the leading causes of death and LBW is another ABO that contributes to Neonatal Mortality Rate

(NMR) mainly indirectly through its association with hypothermia, sepsis and other causes of NMR (14). Preterm birth is the 3rd leading cause of neonatal deaths, accounting for 18.5% of the total neonatal deaths in 2015 (9). In Ethiopia, it has been shown that 20% of under-five death is attributable to low birth weight (8). Studies show that children born preterm are at higher risk to develop cognitive, visual, hearing, behavioral, social-emotional, and growth problems, that persist throughout a child's life into adulthood (15). As a result, the birth of a preterm or low birth weight infant can have significant emotional and economic effects on the infant's family (16); as well disability and non-communicable diseases globally (8). Because of growth impairment, for preterm born children, it is common to phase learning problems (17). Acute respiratory, gastrointestinal, immunologic problems (14) and hypothermia (19) are some of the short-term problems occurring among preterm infants.

Preterm birth and low birth weight are attributable to many factors some of which are increase in maternal age, use of early cesarean sections, labor inductions, multiple pregnancy, history of obstetric complications, maternal infection and chronic maternal health problems (16) Maternal behavioral practices such as tobacco use, alcohol consumption, dietary habit and antenatal care uptake are also major contributors to low birth weight and preterm birth (21). Maternal socio demographic variables are also other factors contributing to preterm birth and low birth weight (18). However, less has been studied regarding the factors associated with preterm birth and low birth weight particularly in Benishangul Gumuz regional state, The region is less accessible because of its geographical location, and the socio-cultural background of the communities mainly health seeking behavior. Hence, this study assessed factors associated with low birth weight and preterm deliveries at Assosa Zone, Benishangul Gumuz regional state, Ethiopia.

Methods

Study setting, design, period, and population

Facility based cross-sectional study was employed from March 11 to May 30, 2020 at randomly selected 2 hospitals and 18 health centers in Assosa Zone, Benishangul Gumuz Regional state. Assosa Zone is located around 670 kilometers away from Addis

Ababa, the capital of Ethiopia. It has a population of 342,287; with around 200,000 males and 170,000 female population (2007 census projected). The zone has 7 districts and more than 70 kebeles. The zone is the second-largest region in the under-5 mortality rate with 98/1,000 live births. Therefore, the study was conducted among mothers who gave birth in the selected health facilities, and only those mothers with known gestational age, date of delivery, and weight of new born were included in the study.

Sample size determination and data collection methods

The sample size was calculated using Epi-Info version 7.2.0.1, with a confidence interval of 95% and an odds ratio of 4.29 for ANC follow-up, among other strongly associated variables (19), and was computed to be 434. Finally, after adding a 10% non-response rate the total sample size became 477. The sample size was assigned to the randomly selected hospitals and health centers proportionally based on average delivery rate of two months prior to data collection. Finally, women who gave birth in selected health facility were selected by using a systematic random sampling technique.

Data was collected by trained midwives. Data regarding maternal socio-demographic and other maternal variables were collected by interviewing the mothers using a questionnaire which was coded by using census and survey processing (CS-Pro) system version 7.3 and deployed to Census and survey entry (CS-Entry) android application. Data regarding the outcome variables (preterm birth and low birth weight) was obtained by review of each of the respondent's card.

Data interpretations

The outcome variable in this study was birth outcome, which was further categorized in to preterm birth and low birth weight with the current birth.

Preterm birth: any birth outcome reported as preterm birth or as Gestational Age (GA) at birth of 28-37 weeks.

Low birth weight: a report of birth weight < 2.5 kgs (2500 grams) or reported as low-birth weight, in the mother's card.

In case of births with co-existed preterm birth and low birth weight, the birth outcome represented the one which was reported as a primary diagnosis.

Data analysis

The collected data was exported to SPSS version 25.0. Descriptive analysis was done and presented as frequency tables and percentage for categorical variables. Binary logistic regression model was used to determine the independent predictors of outcome variables. Those variables which had a significance level of less than 0.25 on bivariate analysis were transferred to multiple binary logistic regression. Finally, the association between dependent and independent variables was assessed using adjusted odds ratio with 95% CI and p-value <0.05. Those variables with a p-value of < 0.05 in the multivariable analysis were considered as a significant predictor of low birth weight and preterm birth.

Results

Socio-demographic characteristics of the respondents

A total of 477 study subjects who fulfilled the inclusion criteria were participated in this study. Most of the mothers 306 (64.2%) were in the age category of 20-29 years. Near all, 459 (96.2%) of the respondents were married and living with their husbands. Regarding occupation of the respondents 288 (60.4%) were housewife. One hundred fifty-five (32.5%) respondents belong to Berta Ethnic group followed by Amhara 154 (32.3%) and Oromo 136 (28.5%). More than half 271 (56.8) of the respondents were Muslim religion followers (Table 1).

Obstetric and medical history of the mothers

Concerning gravidity of the mothers, 322 (67.5%) of the study subjects were having two or more pregnancies (multigravida) and the remaining 155 (32.4%) were having only one pregnancy (prim gravida). The inter pregnancy interval, in 332 (69.6%) of the study participants, was less than 24 months. Four hundred thirty-three (90.8%) of the mothers had ANC follow up, from which 162 (37.3%)

had at least 4 ANC visits.

Table 1: Socio-demographic characteristics of respondents, in Assosa zone health institutions, Benishangul Gumuz Regional state, Ethiopia, 2020 (n = 477).

Variables	Response	Frequency	Percentage (%)
Mother's age	15- 19	112	23.5
	20-29	306	64.2
	30	59	12.4
Marital status	Unmarried	18	3.8
	Married	459	96.2
Ethnicity	Berta	155	32.5
	Oromo	136	28.5
	Amhara	154	32.3
	Other	32	6.7
Religious	Orthodox	145	30.4
	Muslim	271	56.8
	Protestant	61	12.8
Residence	Urban	273	57.2
	Rural	204	42.8
Occupation of the mother	Housewife	288	60.4
	Farmer	89	18.7
	Government employee	57	11.9
	Other	43	9.0
Educational status of the mother	Unable read & write	106	22.2
	Primary (1-8)	199	41.7
	Secondary (9-12)	89	18.7
	Diploma and above	83	17.4
Monthly income	<1000 ETB	24	5.0
	1000-2500 ETB	132	27.7
	2501-5000 ETB	262	54.9
	More than 5000	59	12.4
Number of family	<5	374	78.4
	≥5	103	21.6

ETB stands for Ethiopian Birr

Three hundred ninety-nine (83.6%) and 437 (91.6%) received TT immunization and iron folate supplements, respectively. In 45 (9.4%) of the cases labor was initiated by medical induction, whereas in the rest 432 (90.6%) labor commenced spontaneously. Delivery was effected vaginally in 439 (92.0%) of the mothers. About eight in ten, 383 (80.3%), reported they used contraceptives prior to this pregnancy, of which near to half 244 (51.2%) used short acting family planning methods. In this study, 48 (10.1%) of participants had history of pregnancy related complications. Premature rupture of membrane had occurred among 107 (22.4%) of the respondents (Table 2).

Form the total of 472 mothers who respond they were tested for HIV, only 2 (0.4%) reported the finding was positive. Regarding the maternal behavioral practices, only very few 4 (0.8%) reported they

have ever smoked and similar number responded they used to drink alcohol. see details in (Table 2).

Table 2: Obstetric and medical history of the mother, in Assosa zone health institutions, Benishangul Gumuz Regional state, Ethiopia, 2020 (n = 477).

Variables	Response	Frequency	Percentage (%)
Number of pregnancy	Prim gravida	155	32.5
	Multi gravida	322	67.5
Onset of Labor	Induced	45	9.4
	Spontaneous	432	90.6
ANC service	Yes	433	90.8
	No	44	9.2
Number of ANC visit (n = 33)	<4 Visit	271	62.6
	≥4 visit	162	37.4
Immunization	Yes	399	83.6
	No	78	16.4
Iron supplementation	Yes	437	91.6
	No	40	8.4
Birth Spacing	<24months	332	69.6
	≥24months	145	30.4
Family planning utilization history	Yes	383	80.3
	No	94	19.7
Method of Family Planning (n = 383)	Short acting	244	63.7
	Long acting	139	36.3
Human immunodeficiency virus Test	Yes	472	99.0
	No	5	1.0
Result of HIV test (n = 472)	Positive	2	0.4
	Negative	470	99.6
Complication during Pregnancy	Yes	81	17.0
	No	396	83.0
Occurrence of PROM	Yes	107	22.4
	No	370	77.6
APH	Yes	6	1.3
	No	471	98.7
Medical disorder	Yes	31	6.5
	No	446	93.5

ANC: Antenatal; PROM: Premature rupture of membrane; APH: Antepartum hemorrhage

Factors associated with low birth weight and preterm birth

On bivariate analysis pregnancy related complications, history of still birth, medical disorder, Mode of delivery, duration of pregnancy < 37 weeks, inter- pregnancy interval <24 months, and additional meal during pregnancy were significantly associated with low birth weight. Where residence, woman's educational status, medical disorder, premature rupture of member and inter pregnancy interval less than 24 months were significantly associated with preterm birth. After controlling the possible cofounders, multivariable logistic regression analysis was determined, that the odds of giving birth to a baby with low birth weight increases with, having pregnancy related complications (AOR = 2.4, 95% CI: 1.1-5.6), history of still birth [AOR = 3.3, 95% CI: 1.3-8.3], birth at a GA < 37weeks (AOR = 5.0, 95% CI: 2.7-9.6), inter-pregnancy interval of < 24months

(AOR = 1.9, 95% CI: 1.1, 3.7) and not using additional meal during pregnancy [AOR = 2.3, 95% CI: 1.1-4.4] (Table 3).

Similarly, rural residence [AOR= 2.7, 95%CI (1.6, 4.7), 24-month inter-pregnancy interval AOR = 1.7, 95% CI: 1.1-2.9), and maternal educational level were found to be associated with preterm birth. Inability to read and write (AOR = 5.4, 95% CI: 2.0-12.8), as well as attending only primary (AOR = 2.8, 95% CI: 1.2-6.5) or secondary school (AOR = 3.3, 95%CI: 1.4-7.9) were found to increase the odds of having a preterm birth when compared to having diploma and above (Table 4).

Table 3: Factors associated with low birth weight Public Health Facilities at Assosa Zone, Benishangul Gumuz regional state, Ethiopia, 2020 (n = 477).

		Low birth weight		AOR (95%CI)	p-Value
		Yes N (%)	No N (%)		
Pregnancy related complications	Yes	24 (27.3)	57 (14.7)	2.4 (1.1-5.6)	0.03
	No	64 (72.7)	332 (85.3)	1	
History of still Birth	Yes	13 (22.0)	15 (5.7)	3.3 (1.3-8.3)	0.01
	No	46 (78.0)	248 (94.3)	1	
Medical disorder	Yes	11 (12.5)	20 (5.1)	0.6 (0.2-2.9)	0.507
	No	77 (87.5)	369 (94.9)	1	
Duration of pregnancy	<37 weeks	45 (51.1)	71 (18.3)	5.0 (2.7-9.6)	0.001
	≥37 weeks	43 (48.9)	318 (81.7)	1	
Inter- pregnancy interval	<24 months	69 (78.4)	263 (67.6)	1.9 (1.1-3.7)	0.04
	≥24 months	19 (21.6)	126 (32.4)	1	
Use of additional daily meal during pregnancy	No	51 (58.0)	161 (41.4)	2.3 (1.1-4.4)	0.01
	Yes	37 (42.0)	228 (58.6)	1	

Table 4: Factors associated with preterm delivery at Public Health Facilities at Assosa Zone, Benishangul Gumuz regional state, Ethiopia, 2020 (n = 477).

		Preterm birth		AOR (95%CI)	p-Value
		Yes Number (%)	No Number (%)		
Residence	Rural	74 (64.3)	199 (55.0)	2.7 (1.6-4.7)	0.001
	Urban	41 (35.7)	163 (45.0)	1	
Educational status of the mother	Unable to read and write	39 (33.9)	67 (18.5)	5.4 (2.0-12.8)	0.001
	Primary (1-8)	42 (36.5)	157 (43.4)	2.8 (1.2-6.5)	
	Secondary (9-12)	26 (22.6)	63 (17.4)	3.3 (1.4-7.9)	
	Diploma and above	8 (7.0)	75 (20.7)	1	
Inter- pregnancy interval	<24 months	88 (76.5)	244 (67.4)	1.7 (1.1-2.9)	0.031
	≥24 months	27 (23.5)	118	1	

			(32.6)		
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Discussion

The study was conducted to assess factors associated with low birth weight and preterm birth in public health facilities at Assosa Zone, Benishangul Gumuz, Ethiopia. Accordingly, mothers who encountered complications during current pregnancy have the odds of 2 times higher to give low birth weight baby compare to their counterparts. This is congruent with previous study in Nepal in which it was also identified that having at least one form of pregnancy related health problems during pregnancy increases the likelihood of birth to low birth weight by 3 (19). A study in Mekele also supports this finding (4). The most frequently occurring pregnancy related complications including hypertensive disorder and anemia are known to impair flow of blood, nutrients, and oxygen to the fetus. With inadequacy of these vital substances, it is inevitable for the fetal growth to be limited and the pregnancy to end up with low birth weight. Having history of still birth was also found to increase the chance of low birth weight in subsequent pregnancy; this is supported with a previous report from Gondar (20).

This study has indicated that the odds of having low birth weight baby is 5 times higher for deliveries before 37 weeks of gestation than after. This finding is in agreement with the studies conducted in Gondar, Dangla, and Tigray (20-22). This can be justified with the fact that, a baby born early has less time in the mother's uterus to grow and gain weight and much of fetal weight is gained during the third trimester of pregnancy (53). As meeting maternal nutritional demand during pregnancy is a vital element for fetal development and growth, the current study has identified that, mothers who had no additional daily meal during pregnancy have 2 times higher odds to deliver low birth weight baby. Furthermore, shorter inter-pregnancy interval of less than 24 months doubles the odds of delivering low birth weight baby as compared to those who have inter pregnancy interval greater than 24 months. This finding is in line with the study conducted in Kembata-Tembaro, Butajira, Amhara region and Gamogofa, Ethiopia (23-26). Mothers with shorter inter pregnancy interval do not get sufficient time to recover

from the nutritional burden and stress of the previous pregnancy compared to women with inter pregnancy interval greater than 24 months. This may lead to maternal nutrition depletion (27), that in turn has great implication on the fetal growth and weight gain.

Being a rural resident was associated with preterm birth with odds of 2.7. Similar findings were reported from previous studies in different areas of Ethiopia (28). This could be justified with different facts, such as possible poor uptake of prenatal service and lower level of awareness on perinatal nutrition among rural residents as compared to those residing in urban area. Those mothers who did not able to read and write were 5 times at greater risk of delivering preterm babies compared to their counterparts. This finding is consistent with the study done in Amhara region public hospitals, in Ethiopia (29).

The odds of delivering preterm babies among mothers with short birth interval (less than 24 months) with previous pregnancy were 2 times higher compared to women having longer birth intervals (greater than 24 months). This finding is in agreement with the study done in Amhara region, Ethiopia (25). The preterm birth may not be the result of short inter-pregnancy interval itself, rather may be due to correlated maternal risk factors.

The limitation of this study is, primarily the cross-sectional nature of the study design may not show cause effect relationship. In addition, the study might have subjected to recall bias due to different recall of information among mothers. On the other hand, nutritional status of the mothers was not studied in detail and therefore it may not indicate mother's nutritional status to a maximum level.

In conclusion in this study it was identified that complications during pregnancy, history of still birth, and no additional daily meal during pregnancy were found to be significant predictors of low birth weight. Low maternal educational status and rural residence were associated with low birth weight. Where, shorter interpregnancy interval is found to be strongly associated with low birth weight and preterm birth.

The interpregnancy space is very important issue to be addressed by the concerned maternal and reproductive health care providers. It is worthwhile to focus on the antenatal and post-natal family

planning service and to integrate these services.

Abbreviations

ABO: Adverse Birth Outcome

ANC: Antenatal Care

EDHS: Ethiopian Demographic and Health Survey

HTN: Hypertension

Kgs: Kilograms

LBW: Low Birth Weight

NMR: Neonatal Mortality Rate

PTB: Preterm Birth

SDG: Sustainable Developmental Goal

SGA: Small Gestational Age

LMP: Last Menstrual Period

UNICEF: United Nation International Children's Emergency Fund

USAID: United States Agency for International Development

UTI: Urinary Tract Infection

WHO: World Health Organization

Declarations

Ethics approval and consent to participate

Before data collection, the letter of ethical clearance was obtained from Ambo University Health Science collage research review and ethical committee. Permission letter was obtained from Assosa General Hospital and selected health centers. Verbal consent was obtained from the participant of the study. Participation was on voluntary basis and the participants were told they can withdraw from the study at any time in the middle of their participation. Privacy and confidentiality of collected information was ensured at all by using password protection for soft the copy data. Where data with hard copy was locked and kept in a safe place in order to guarantee confidentiality.

Consent for publication

Not applicable

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Authors' contributions

TA, EE and MA contributed in conception of the idea, designing the work, analyzing and interpreting the data, drafting and substantively revising the work. DB and EN have contributed by designing the work, drafting and revising the document and in preparing the paper for manuscript. TT has contribution in drafting the manuscript. All the Authors have approved the submission of this final version. They have also agreed both to be personally accountable for own contribution and to ensure that questions related to the accuracy or integrity of any part of the work.

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Competing interest

It is the declaration of the authors that none of them has conflict of interest in all matters in this manuscript.

Availability of data and materials

All the relevant data are generated in line with the objectives and included in this article. If supplemental information is needed, the datasets used during the current study are available from the corresponding author on reasonable request.

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